5.0 RADIOLOGICAL MONITORING RESULTS

Radiological monitoring results from onsite environmental programs included effluent sampling results for airborne emissions and liquid discharges to containment ponds and environmental sampling results for onsite surveillance conducted by Bechtel Nevada (BN). Offsite environmental surveillance was conducted by the U.S. Environmental Protection Agency's (EPA's) Radiation and Indoor Environments National Laboratory - Las Vegas (R&IE-LV). Onsite monitoring results indicated that environmental concentrations of radioactivity resulting from Nevada Test Site (NTS) air emissions were statistically no different than background, except in the immediate vicinity of the emissions. These airborne emissions, and radioactive liquid discharges to onsite containment ponds, produced concentrations that were only a fractional percentage above background in terms of potential exposure of onsite workers. Offsite monitoring indicated that environmental radionuclide concentrations and exposure rates were statistically no different than background, with no measurable exposure of offsite residents from current NTS activities. Small amounts of tritium were detected in some vegetation collected onsite.

5.1 RADIOLOGICAL EFFLUENT MONITORING

Since no nuclear tests were performed at the NTS during 1996, monitoring efforts for radioactive effluents consisted primarily of routine air sampling and periodic sampling of liquid discharges to the Area 12 tunnel containment ponds. Air samples collected in and around the Area 5 Radioactive Waste Management Site (RWMS-5) indicated that no measurable radioactivity was detectable away from the area, although trace amounts of tritium were detected at its boundary. Samples in Area 3, at the Area 9 Bunker, and a few other areas showed above-background levels of $^{239+240}$Pu. Measured ^{85}Kr levels indicated little, if any, emission from Pahute Mesa as had been detected previously. By using data from the station with the highest annual average, replacing the diffuse source with an equivalent point source, and using CAP88-PC, upper limits of 0.27 Ci (10 GBq) of $^{239+240}$Pu, and 1.2 Ci (44 GBq) of ^{3}H were estimated for airborne emissions from the various contaminated areas on the NTS. The primary liquid effluent was water from area 20 characterization wells collected in containment ponds. Influents to these ponds contained 120 Ci (4.4 Tbq) of tritium.

EFFLUENT MONITORING PLAN

An important part of the "NTS Environmental Monitoring Plan" (EMP) (U.S. Department of Energy [DOE] 1991c), as required by DOE Order 5400.1 (DOE 1990b), is the onsite Effluent Monitoring Plan, in which the Area 12 tunnels, the Area 6 Decontamination Facility, nuclear test sites, RWMSs, and all other potential effluent sites throughout the NTS have been assessed for their potential to contribute to the dose to offsite residents.

Airborne radioactive effluents are the emissions on the NTS with the greatest potential for reaching members of the public. All radioactive liquid effluents from activities on the NTS are contained within its boundaries. For all activities on the NTS, the estimated effective dose equivalent to any member of the public from all airborne radionuclide emissions is much less than one mrem/yr. Requirements of the "National Emission Standards for Hazardous Air Pollutants" (NESHAP) are set forth in Title 40 C.F.R. 61.93(b)(4)(ii), and in Regulatory Guide DOE/EH-0173T (DOE 1991d). Compliance with these requirements is achieved by periodic measurements of effluents to confirm the low emission levels. For consistency with past practices, the monitoring methods and procedures developed over the years are being used with changes being introduced as conditions warrant.

AIRBORNE EFFLUENTS

No nuclear tests were performed during 1996, so there were no test-related effluents. The majority of radioactive air effluents at the NTS in 1996 originated from tritiated water (HTO) seeping from E Tunnel and pumped from characterization wells, resuspension of contaminated surface soil, and seepage of ^{85}Kr from underground tests with various amounts of other radionuclides calculated from monitoring data (see Table 5.1 for a listing of onsite releases).

An increase in efforts to monitor radioactive air emissions at the NTS began in November 1988, as a result of requirements in DOE Order 5400.1, DOE Order 5400.5, and Regulatory Guide DOE/EH-0173T, as well as from EPA requirements in the NESHAP, Title 40 C.F.R. 61. Known and potential effluent sources throughout the NTS were assessed for their potential to contribute to public dose and were considered in designing the Site Effluent Monitoring Plan, which forms part of the "Environmental Monitoring Plan, Nevada Test Site and Support Facilities," DOE/NV/10630-28, published in November 1991. This plan was updated in 1992 and 1993.

CHARACTERIZATION WELL EFFLUENT

As part of environmental restoration activities, the groundwater under the NTS is being characterized by drilling special wells for measuring the characteristics of NTS aquifers. In 1996, such wells were drilled near the cavity created by a nuclear explosive test. The water pumped from these wells into containment ponds was contaminated with tritium. Measurement of the tritium concentration and volume of water discharged gives a source term for this activity. The total discharged is shown in Table 5.1.

TUNNEL COMPLEX EFFLUENT

As noted above, there was fluid drainage from the E Tunnel complex during 1995. The HTO content is shown in Table 5.1.

RADIOACTIVE WASTE MANAGEMENT SITES

A permanent particulate sampler was located within disposal pit 5 at the RWMS-5. The 1996 annual average concentration of gross beta activity in samples taken within Pit 5 was 1.8×10^{-14} µCi/mL (0.67 mBq/m^3), the same as the site-wide average. Pit 5 was opened and this air sampler was installed in 1995. These results indicate that, except for trace amounts of tritium as noted below, the operations in the RWMS-5 are not contributing radiological effluents to the NTS environment. Average annual gross beta and plutonium results for 1996, from all the samples collected at the RWMS-5 facility, are shown in Figure 5.1.

Nine HTO samplers were located on the perimeter of RWMS-5 as shown in Figure 5.2. The 1996 annual average HTO concentration for the nine stations was 3.6×10^{-6} pCi/mL (0.13 Bq/m^3). The individual

Click view Figure 5.1

Figure 5.1 RWMS-5 Air Sampling Annual Average Results - 1996

Click to view Figure 5.2

Figure 5.2 RWMS-5 HTO Annual Average Results - 1996

values are displayed in Figure 5.2. This value is less than 0.06 percent of the derived concentration guide (DCG) for HTO vapor in air.

The Area 3 RWMS (RWMS-3) is used for disposal of radiologically contaminated waste in packages that are unsuitable for disposal in the Area 5 facility. This waste is buried in subsidence craters much like waste is buried at the RWMS-5. The RWMS-3 is surrounded by four permanent particulate samplers located approximately north, south, east, and west of the burial pit. Several thermoluminescent dosimeters (TLDs) were distributed at the RWMS-3 and surrounding areas.

Although a statistical analysis shows that there are differences between NTS areas in levels of environmental exposure, there were not enough data to determine the pattern of the differences. Nevertheless, an examination of annual average exposure rates shows that the gamma exposure rates detected at the perimeter fences of RWMS-3 and RWMS-5 are similar to gamma exposure measurements taken at other locations on the NTS.

The gross beta 1996 annual average at the RWMS-3 of 1.6×10^{-14} µCi/mL was slightly lower than the 1995 average and was not statistically different at the 5 percent significance level from the site-wide average of 2.0×10^{-14} µCi/mL (0.74 mBq/m^3). However, $^{239+240}$Pu results indicated that levels of these radionuclides in the vicinity of the RWMS-3 were consistently above the NTS average. Vehicular traffic and operational activities in Area 3 apparently resuspended plutonium that was deposited on the soil surface during earlier nuclear explosives testing. These elevated $^{239+240}$Pu levels indicated that Area 3 is a diffuse source of effluents. Air sampling results are displayed in Tables 5.2, 5.3, 5.4, and 5.5.

LIQUID DISCHARGES

The radioactive liquid discharges at the NTS in 1996 originated from tunnel drainage and from water pumped from characterization wells in Area 20. Typically, all liquid discharges within the NTS have been held in containment ponds. Monthly grab samples were taken from each pond and, where possible, from the influent.

Radioactivity in liquid discharges released to the containment ponds was monitored to assess the efficacy of tunnel sealing and provide a quantitative and qualitative annual summary of the radioactivity released onsite for use in calculating doses for NESHAP compliance.

TUNNELS

Rainier Mesa in Area 12 is the location where nuclear tests were conducted within tunnels by the U.S. Department of Defense (DOD). Seepage water discharged from these tunnels was collected in containment ponds as described above. This water was usually contaminated with radionuclides, mainly ^{3}H, generated during nuclear tests in previous years.

Liquid effluents were discharged during 1996, only from E Tunnel. The liquid discharge from this tunnel decreased during 1996, compared to previous years, because of success in sealing the tunnels. Monitoring results indicated that the water discharged from E tunnel contained measurable quantities of ^{3}H and small amounts of other radionuclides. Total quantities of ^{3}H, ^{238}Pu, $^{239+240}$Pu, ^{90}Sr, ^{137}Cs, and beta activity were determined for this liquid effluent source and are listed in Table 5.1. No liquid effluents were discharged offsite.

CHARACTERIZATION WELL EFFLUENT

The total volume of liquid discharged to containment ponds from the characterization wells in Area 20 during 1996 was 2,980,000 gal (11,300 m^3) that contained 119.9 Ci of tritium. This included wells drilled in 1995 that were still being pumped and a new set of wells for this year.

DECONTAMINATION FACILITY

Since no nuclear tests were conducted in 1996, only insignificant amounts of materials were treated at the Decontamination Facility in Area 6. Until a new lined containment pond is constructed, any effluent from that facility will be captured in holding tanks and held for disposal.